CALIFORNIA DIVISION OF MINES AND GEOLOGY

FAULT EVALUATION REPORT FER-213

JAVON CANYON FAULT

Ventura County, California

by

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INTRODUCTION

The Javon Canyon fault (Sarna-Wojcicki and others, 1979) is an east-west trending, south-dipping reverse fault at the northern margin of the western Ventura Basin (Figure 1). It is located within an active fold belt in southwestern Ventura County which includes the Ventura anticline and the active, north-dipping Red Mountain fault zone. It has been mapped at the shoreline northwest of Pitas Point and traced or projected eastward for approximately 2.5 to 4 miles (4 to 6.4 km). The Javon Canyon fault is an upward continuation or splay of the sub-surface Padre Juan fault which separates the Ventura and San Miguelito anticlines from the Rincon anticline. Sarna-Wojcicki and others (1987) have described evidence of repeated Holocene displacement within Javon Canyon and they infer a long term rate of vertical displacement of 1.1 mm/yr. The fault has been portrayed in slightly different locations (Figure 2a) by various workers (Dibblee, 1988; Sarna-Wojcicki and others, 1987; Grigsby, 1986; CDMG, 1975).

The purpose of this evaluation is to determine if there is sufficient evidence along any of the various mapped fault traces to meet the criteria of "sufficiently active and well defined" as required for zoning under the Alquist-Priolo Special Studies Zone Act (Hart, 1988).

SUMMARY OF AVAILABLE DATA

Faults have been shown in the vicinity of Javon Canyon on published maps since as early as 1942 (Putnam, 1942) although all of the early maps were at a small scale (1 mile = 1 inch or less) and included little detail (also Bailey, 1943; Bailey and Jahns, 1954; Jennings and Troxel, 1954). The first map of the subject fault published on a topographic base had a scale of 1:48,000 (Weber and others, 1973; CDMG, 1975) and showed several unnamed faults south of the Padre Juan fault, one of which roughly corresponds with the Javon Canyon fault as considered herein. This map was in part compiled from unpublished oil company sources.

[The "Padre Juan fault" as compiled by Weber and others, (1973) and CDMG (1975) has been shown by later workers as the South Strand of the Red Mountain fault (Sarna-Wojcicki and others, 1987) or as the Rincon anticline (Dibblee, 1988; Grigsby, 1986 and 1988). It was evaluated as a possible fault in FER-21 (Smith, 1977) and was not found to have any clear indications of recent faulting.]

Grigsby (1986) clarified the relationship of the Javon Canyon fault, at the surface, to the subsurface Padre Juan fault as defined in the San Miguelito and Rincon oil fields. He interpreted the Javon Canyon fault as a very young upward splay of the Padre Juan fault east of Javon Canyon and as a more direct young upward continuation west from Javon Canyon. In the subsurface the Javon Canyon fault dips 60 to 70 degrees south and may extend laterally from north of the "San Miguelito Amphitheater" westward offshore [Figure 2a]. Grigsby (1986) stated that there is maximum of 2,800 m reverse separation at the "middle" Pico- "lower" Pico contact. The Javon Canyon fault was mappable at the surface only in the vicinity of Javon and Padre Juan canyons and was inferred eastward based on subsurface mapping (Grigsby, 1986). Grigsby's surface map was based on a number of sources, including Weber and others (1973), Sarna-Wojcicki and others (1979) and unpublished mapping by Dibblee and by Conoco geologists. The offshore extension is inferred from a dip reversal in an offshore well (Grigsby, 1986). Sarna-Wojcicki and others (1987) cited other possible offshore extensions which would require a change in trend to make a connection.

Sarna-Wojcicki and others (1987) described multiple offsets of Holocene deposits in Javon Canyon (first reported in Sarna-Wojcicki and others, 1979) as well as displacement of older terrace deposits on the ridge between Javon Canyon and Padre Juan Canyon. In Javon Canyon stream terrace deposits, graded to the Sea Cliff terrace [dates range from 1820 to 5535 y.b.p.] are offset about 4 m along a fault striking N 82 W and dipping 68° S. Overlying debris aprons are believed to represent fault scarp debris from additional post-terrace rupture events. On the ridge southeast of Javon Canyon two isolated patches of a 45,000 year old terrace are offset vertically, relative to each other, by 42 to 49 meters across a fault zone which is located within a 50 to 60 foot variance (Sarna-Wojcicki, personal communication, 1989). Based on displacements and age determinations at these two localities Sarna-Wojcicki and others (1987) infer an average slip-rate of 1.1 mm/yr. for the past fifty thousand years. To the west of Javon Canyon they located the fault based on a faint air photo lineament and the abrupt termination of Holocene marine gravels locally exposed in a low roadcut along the old coast highway (near BM31). They commented that the fault was obscured or concealed elsewhere.

Dibblee (1988) locally shows roughly the same fault as mapped by Grigsby (1986) or Sarna-Wojcicki and others (1987) but calls it the Padre Juan fault and does not infer it quite as far east or west as Grigsby. His fault trace does not follow the topography as well as those by other workers and it may be a matter of transfer from an older topographic base (Dibblee, personal communication, 1989, indicated that he mapped this area originally in the 1930's).

A possible splay of the Javon Canyon fault was mapped by Weber and others (1973; also CDMG, 1975) trending toward the mouth of Javon Canyon. Sarna-Wojcicki and others (1987) recorded a reverse fault striking northwesterly and dipping 80 degrees to the southwest in a stream exposure at the mouth of Javon Canyon. Recent trenching by CalTrans (1989) exposed numerous faults and fault-like features in the lower portion of a borrow area (located on Figure 2b), but since the entire area was disturbed most faults were observed only within bedrock. Two discontinuities in later marine sands and colluvial or landslide deposits may be fault related, but may also be merely local erosional unconformities; neither feature was traceable downward into bedrock. In the stream to the northwest of the trench Sarna-Wojcicki was not able to relocate the fault previously mapped at the canyon mouth but did observe a small vertical fault which offset the bedrock platform and overlying Holocene stream terrace deposits (up to 20 inches vertical separation). This fault could be found in only one side of the stream and, with a strike of N 82° E, did not project toward the CalTrans trenches (Sarna-Wojcicki, 1989).

SEISMICITY

A plot of earthquake epicenters for events greater than or equal to magnitude 1.0 for the interval 1969-1984 is included as figure 3. There is no correlation of epicenters to the Javon Canyon fault within this data set.

GEODETICS

A profile of relative elevation changes along the Ventura coast shows a sharp contrast in these changes across the trend of the Javon Canyon fault, the southeast side having been relatively uplifted approximately 0.16 feet more than the northwest side between 1939 and 1971 (Buchanan-Banks and others, 1975). Their paper points out, however, the possible influence of oil-field subsidence on the relative elevation changes.

AIR PHOTO INTERPRETATION

Photos from various dates (1928 to 1980) and scales (1:3,000 to 1:36,000) were studied for features suggestive of Holocene faulting (see list of aerial photographs used). Although several unusual or anomalous features were observed (Figure 2b), none coincided with any of the previously mapped traces. Much of the topography along the fault zone has been modified by landsliding. Chaparral vegetation probably obscures what few features may exist. Air photo lineaments reported by Sarna-Wojcicki and others (1987) could not be verified in black and white prints of the 1974 USGS air photos they used (originals used by USGS were color) or in other photographs.

The most obvious feature in the air photos is a tonal contrast roughly coinciding with a break in slope north of the mouth of

Javon Canyon. Reference to the 1928 photos shows that the tonal contrast is a result of ranch activity and probably involves a fenceline. The actual break in slope is somewhat less linear and is probably a natural slope break (b/s on Figure 2b) at the back of an unmapped terrace. A very weak tonal lineament on the coastal terrace to the west (Photo AXI-5K-20) may be fault related or may be associated with an irregular trench spoil pile visible in the 1928 photos (C-297-B-16).

Other possible fault features (slope breaks and sidehill benches) on the lower slope southeast of Javon Canyon may merely be related to late Holocene stream incision and landsliding. A fairly prominent sidehill bench further upslope near the southeast corner of section 16 is oblique to bedding. It does not coincide with any mapped faults but is parallel to a splay fault mapped by Weber and others (1973; CDMG, 1975) and Sarna-Wojcicki and others (1987). It may be a lateral spread feature or an incipient landslide scarp above a possible old landslide. The splay mapped by Weber and others (1973; CDMG, 1975) and in part by Sarna-Wojcicki and others, (1987) should trend through the borrow area south of the mouth of Javon Canyon, but is not visible in large scale photos taken during excavation nor in subsequent photos where continuous bedding is visible across the cut area. Local discontinuities at the high eastern edge and lower western margin of the cut slope are probably landslide related; locally contorted bedding at mid-slope does not continue in a manner consistent with the mapped fault.

FIELD OBSERVATIONS

West of Javon Canyon, road cuts were inspected for evidence of faulting with which to connect the stream bank exposure of Sarna-Wojcicki and others (1987). Several areas of normal faulting were observed along an oil field road. One area of noticeably steepened bedding was within the margin of a landslide (Figure 2b). No faulting was observed along the old highway or railroad cuts but intermittent exposures were not adequate to prove or disprove continuity of bedding or soils.

The discontinuity in marine terrace gravels noted by Sarna-Wojcicki and others (1987) was, apparently, a transition from obviously non-marine fine-grained terrace deposits with one or two old soil horizons north of BM31 (in the railroad cut above the highway) to questionably marine deposits south of this point. Clearly marine deposits are exposed several hundred feet to the south in the highway cut below, characterized by sandy sediments including rounded cobbles (some with pholad borings) and common shells. Closer to the benchmark, however, the highway cut first exposes finer grained sediments and then is completely covered. Above the highway cut is the railroad where questionably marine deposits include some rounded cobbles in a dirtier or more weathered matrix, but no shells or pholad borings. Since this higher cut is within a fan at the mouth of a small canyon, the observed transition from finer-grained sediments to cobbly sands may be merely a filled channel in the fan. No fault topography is visible across this now-incised fan.

To the east of Javon Canyon, faults were usually not observable at the mapped locations (in road and oil well drilling site cuts) and where found faults were not uniquely associated with one trace, casting some doubt on the connection of any two points by a fault trace. Bedrock faults observed in section 23 dip north whereas the Javon Canyon fault is a south-dipping structure. There was no surface expression observed which might indicate recency of movement on any of the mapped traces.

The possible splay mapped through the mouth of Javon Canyon was not observable. The small fault (striking N 82 E) observed by Sarna-Wojcicki (1989) was possibly relocated. The feature I saw, of similar trend, looked more to me like a deep scour and fill of Holocene stream deposits into bedrock. The bedrock was tilted to near vertical and the stream had scoured out a sandy unit relative to adjacent clayey units and then redeposited terrace deposits along this distinct planar near-vertical contact. Although there may be a small bedding-plane fault in the bedrock, I did not see distinct shearing in the terrace deposits. The fault could not be found on strike across the modern stream gully.

DISCUSSION AND CONCLUSIONS

Holocene faulting has been clearly demonstrated at one location (Sarna-Wojcicki and others, 1987) and questionably at two others (near BM31 at the coast and at the mouth of Javon Canyon). The fault however is not well defined. For most of the surface length of the fault (if really known) various workers have plotted the fault trace in different locations. The closest agreement between past workers is from the Holocene coastal terrace to Padre Juan Canyon. The fault is well constrained in the bottom of Javon Canyon and roughly located through a saddle on the ridge between Javon Canyon and Padre Juan Canyon. Elsewhere it is not clearly located. This area is tectonically active with a demonstrated high uplift rate so it is natural that fault features might not be preserved on the young steep canyon slopes. However, I would expect some expression across the more stable coastal terrace and the older elevated surface north of the mouth of Javon Canyon. Sarna-Wojcicki (personal communication, 1989) however believes that sediment transport across these surfaces has been sufficient to obscure fault morphology.

Future trenching most likely would encounter faults but in many cases I expect the bedrock will be overlain by very young mobile soils. Trench investigations on the terrace surfaces could be expected to expose a more useful stratigraphic section.

The various fault exposures at the mouth of Javon Canyon (Sarna-Wojcicki and others, 1987; Sarna-Wojcicki, 1989; CalTrans, 1989) are ambiguous as to age and not traceable or connectable with other features.

RECOMMENDATIONS

Based on evidence of repeated Holocene displacement at Javon Canyon, a moderately well-constrained fault location in the saddle to the east, and additional weak suggestions of faulting to the west I recommend that a Special Studies Zone be established adjacent to the main fault trace as interpreted by Sarna-Wojcicki and other (1987) from the shoreline eastward to 1000' east of the saddle between Javon and Padre Juan Canyons. I also recommend that the zone include suggestive geomorphic features identified in this study which may connect the Javon Canyon exposure to a short splay fault mapped by Sarna-Wojcicki and others (1987). Fault segments recommended for zoning are shown on Figure 2c.

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I have reviewed this FER & concur with the recommendations.
Earl W. Hart
2/2/90

AERIAL PHOTOGRAPHS REVIEWED

Fairchild Aerial Surveys flight C-297	1:24,000 b/w frames B-13 to B-17	7 x 9 1928
USDA flight AXI-4K AXI-5K AXI-6K	~1:27,000 b/w frames 108,109 19,20,21 97,98	9 x 9 1/5/53 7/12/53 9/25/53
Cal. Hwys flight ASC 511-15	1:6,000 b/w frames 1-58 to 1-60	9 x 9 1/5/62
USGS flight GS-VBUK	1:36,000 b/w frames 1-129 to 1-131	9 x 9 8/13/67
Cal. Hwys flight ASC 7212-28	1:3,000 b/w frames 1-19 to 1-21	9 x 9 6/1/72
USGS VEN. CO.	1:24,000 b/w (from color) frames 3-13, 3-14	9 x 9 5/22/74
Pacific Western Aerial Survey flight PW VEN6	~1:26,000 color frames 170 to 173	9 x 9 11/16/88

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Sarna-Wojcicki, A.M., 1989, unpublished letter to CalTrans geologists, June 1, 1989

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